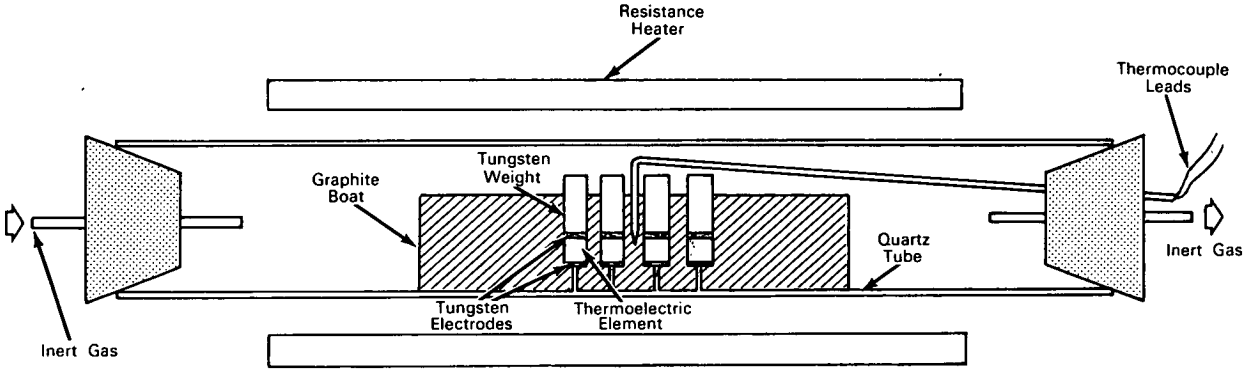
October 1965

Brief 65-10309

NASA TECH BRIEF

Thermoelectric Elements Diffusion-Bonded to Tungsten Electrodes



The problem: To bond lead telluride and lead telluride-tin telluride thermoelectric elements to tungsten electrodes. The bond must have high strength and low electrical and thermal resistance.

The solution: The thermoelectric elements are bonded to the tungsten electrodes by a solid-state diffusion process.

How it's done: The components to be bonded are degreased in boiling propanol, followed by washing under ultrasonic agitation in a solution of a commercial detergent in deionized water, and successive rinsing with deionized water and boiling methanol. The cleaned components are air-dried and then polished on the surfaces to be bonded in a parallel lapping fixture using a series of silicon carbide grits and finally 1800-grit alumina. The polished surfaces to be bonded are carefully fitted together and placed into a graphite boat which is then enclosed in a quartz diffusion tube. Bonding is accomplished in an inert-gas atmosphere at a temperature of 840° to 850°C maintained for 20 minutes.

Notes:

1. This method has also been successfully used for bonding of tantalum electrodes to lead telluride thermoelectric elements.
2. The resulting bonds are nonmagnetic and have high strength and low electrical and thermal resistance.
3. A procedure for solid-state diffusion bonding of thoriated nickel is summarized in NASA Tech Brief B65-10220, Aug. 1965.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B65-10309

Patent status: NASA encourages commercial use of this innovation. No patent action is contemplated by NASA.

Source: TYCO Laboratories, Inc. under contract to Goddard Space Flight Center
(GSFC-346)

Categories 01, 03